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Abstract

FUEL ELEMENTS IN THE DOUNREAY FAST REACTOR

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The original target for fuel elements in the Dounreay Fast Reactor was to enable operation at 60 MW and to achieve 1.2% burn-up (heavy atoms). Following modifications to the design of the element this target has been reached.

The metallic fuel used is an alloy of enriched uranium with 20% molybdenum in an annular form. The fuel is niobium canned. The space between the fuel and can is filled with Na and is deliberately vented to the reactor coolant, NaK.

The real fuel irradiation experience was gained from a series of reactor runs at around 30 MW and from the 60 MW runs. The earlier design of fuel element was taken to a maximum of 0.6% burn-up. Progressive cracking of the fuel occurred from 0.3% burn-up onwards. Volume swelling of the fuel, however, was as predicted from M.T.R. results.

The modification to the element design allowed for 8% diametral swelling within the can. These elements achieved 1.2% burn-up and despite fuel cracking remained externally unchanged.

Corrosion of the niobium can due to oxygen in the reactor coolant has been investigated. The results have indicated that the can temperature must be limited to 480°C to avoid corrosion.

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A few elements have exhibited poor bond flow and fission gas agglomeration. This has caused local overheating on the outer surface of some fuel pieces and in a few instances evidence of surface melting was detected. This phenomenon did not affect the canning of the elements.

Continued development based on these results is taking place and higher burn-ups are believed possible.